

Paisan's Pizza makes gourmet frozen pizzas for sale to supermarket chains. They make only deluxe pizzas, one vegetarian and the other with meat. Their business planning has these constraints.

- Each veggie pizza takes 12 minutes of labor and each meat pizza takes 6 minutes of labor. The plant has at most 3,600 minutes of labor available each day.
- The plant freezer can handle a total of at most 500 pizzas per day.
- Vegetarian pizza is not quite as popular as meat pizza, so the plant makes at most 200 veggies each day.
- The sale of each vegetarian pizza earns \$3 profit and each meat pizza earns \$2 profit.

Determine how many of each type of pizza should be made to maximize profit.

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The plant manager of the Integrated Technologies factory must plan for and supervise production of two video game models, the basic IT-95 and the more advanced IT-2000. Demand for both games is high, so IT can sell whatever is produced. To plan the work schedule, the manager has to think about these conditions.

- Assembly of each IT-95 takes 0.6 hour, and each IT-2000 takes 0.3 hour of technician time. The plant can apply at most 240 hours of technician time to assembly work each day.
- Testing of each IT-95 takes 0.2 hour, and each IT-2000 takes 0.4 hour. The plant can apply at most 160 hours of technician time each day for testing.
- Packaging time is the same for each model. The packaging department of the plant can handle at most 500 games per day.
- The company makes a profit of \$50 on each IT-95 and \$75 on each IT-2000.

Determine how many of each game should be produced in order to maximize profit.

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For some people like astronauts and athletes, the selection of a good diet is a carefully planned scientific process. Astronauts want a high performance diet minimal weight. Consider the following simplified version of the problem facing NASA space flight engineers who must provide food for the astronauts. Suppose there are two kinds of food to be carried on the space shuttle trip: Energy Bars and TANG (powdered drink).

- Each Energy bar provides 5g of fat, 40g of carbs, and 8g protein
- Each carton of TANG provides 6g of fat, 25g carbs, and 15g protein
- Minimal daily requirements are *at least* 61g fat, *at least* 350 g carbohydrates, and *at least* 103g protein.
- Each Energy Bar weighs 65 grams and each carton of TANG weighs 118 grams

Determine what combination of Energy Bars, and TANG will give the minimum daily requirements of fat, carbs and protein with the least total weight.



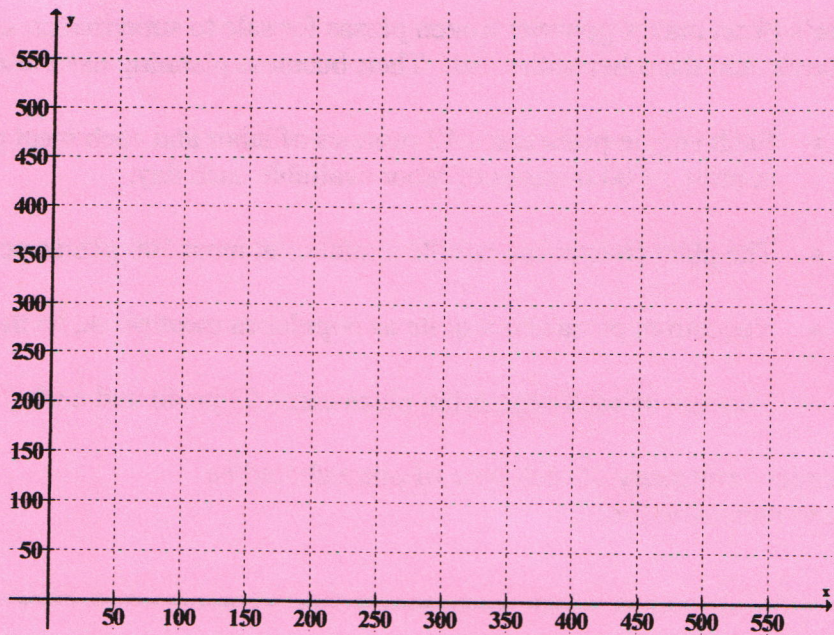
### #1 Paisano's Pizza

Objective Equation:

Constraints:

Test points and resulting values:

Conculusion:



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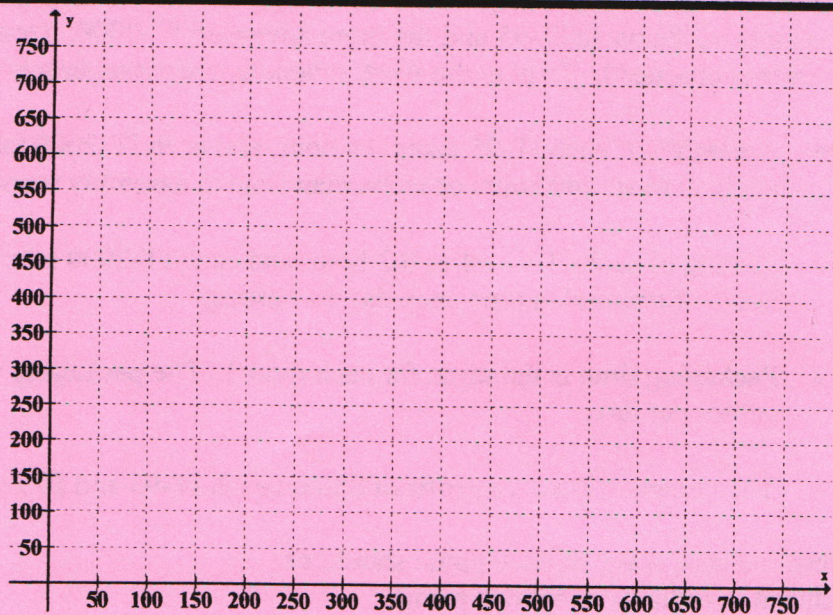
### #2 IT technologies

Objective Equation:

Constraints:

Test points and resulting values:

Conculusion:



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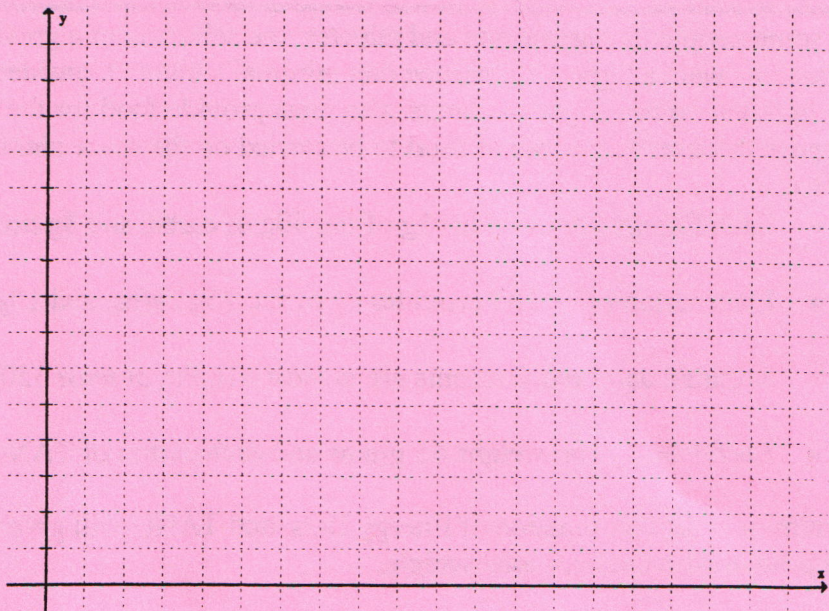
### #3 Astronaut food

Objective Equation:

Constraints:

Test points and resulting values:

Conculusion:

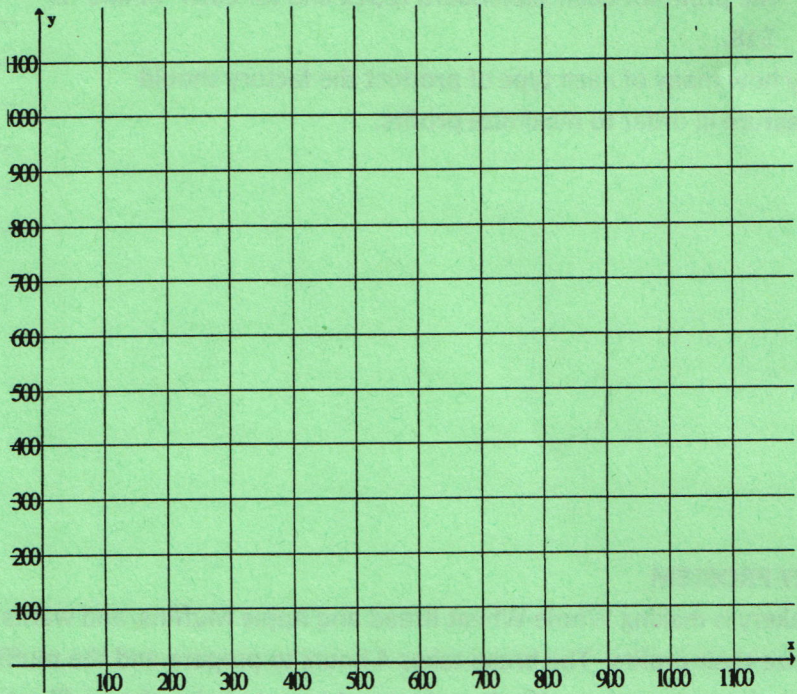




Inspector gadget's factory is preparing for the holiday season making their world famous GIZZMOs and THINGAMABOBS. They need to identify how many of each to produce to maximize their profits.

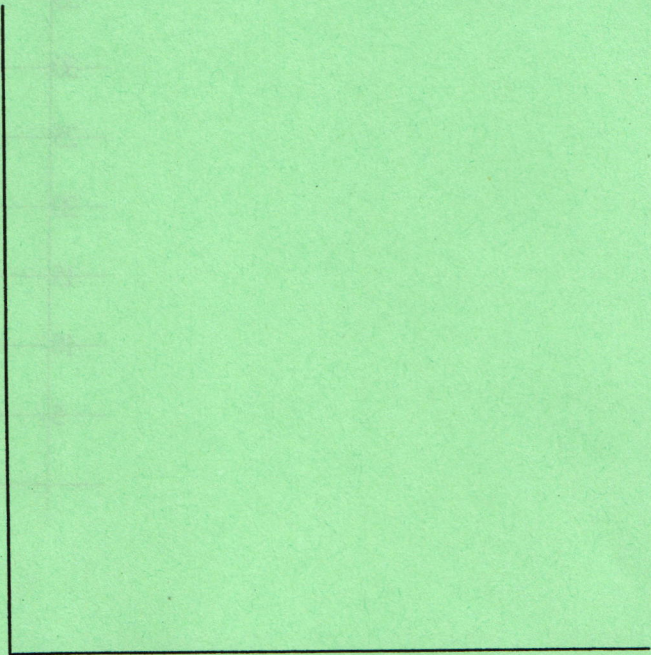
- The assembly time for each GIZZMO is 2 hours; for each THINGAMABOB it is 1 hour, and the factory has at most 800 man-hours to spend on assembly
- The quality control testing takes 0.5 hours for a GIZZMO and 1 hour for a THINGAMABOB; the factory has at most 450 man-hours that can be spent on quality control.
- The factory can make no more than 500 products in 1 day.
- They make a profit of \$10 for every GIZZMO and \$12 on every THINGAMABOB produced.

How many of each product should the factory make in order to maximize their profits?



ARTS AND CRAFTS

You are stenciling wooden boxes to sell at a fair. It takes you 2 hours to stencil a small box and 3 hours to stencil a large box. You make a profit of \$10 for a small box and \$20 for a large one. If you have no more than 30 hours available to stencil, and want to sell at least 12 boxes, how many of each size should you stencil in order to maximize your profit?





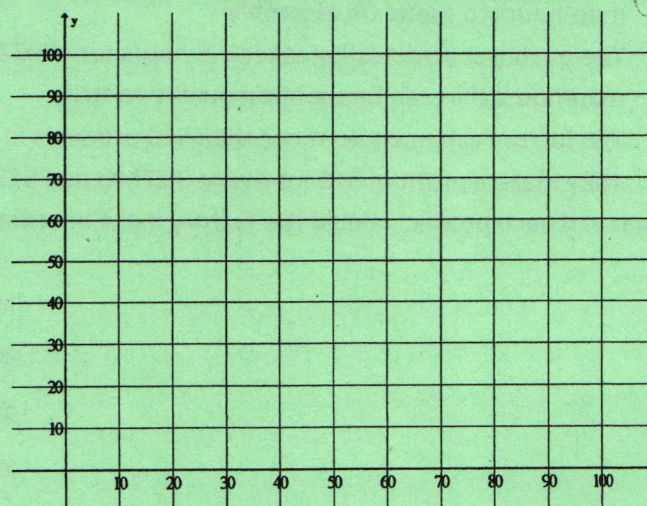
## LINEAR PROGRAMMING

## SK8ER PROBLEM

"Dudes On Wheels" sporting goods factory makes and sells skate boards and in-line skates. The manager of the factory needs figure out how many skateboards and in-line skates they should stock in make each day in order to maximize their profits

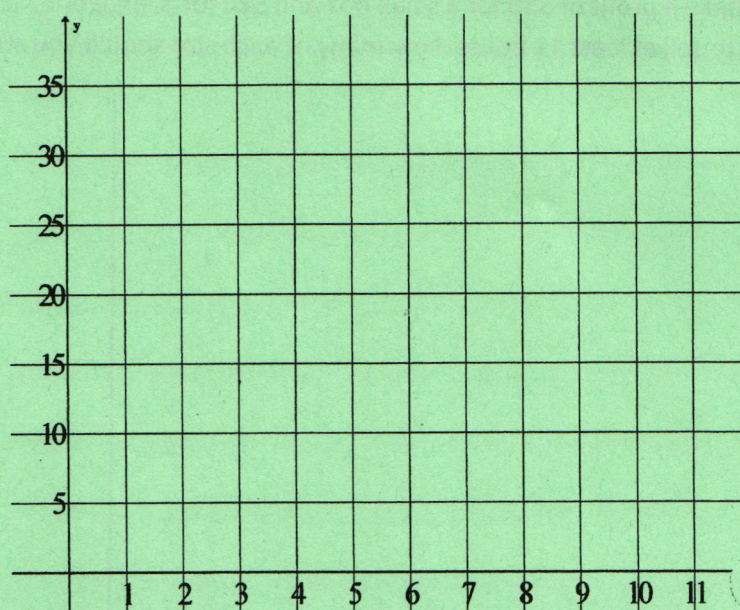
- They must make at least 30 'boards and 20 "in-lines" per day
- The factory can make at most 60 boards per day.
- The factory can make at most 40 "in-lines" per day.
- The total number of items made in a day cannot exceed 90, or the machines will explode.
- The profit for each skateboard is \$12 and for each "in-line" is \$18.

Identify how many of each type of product the factory should manufacture in order to maximize profits.



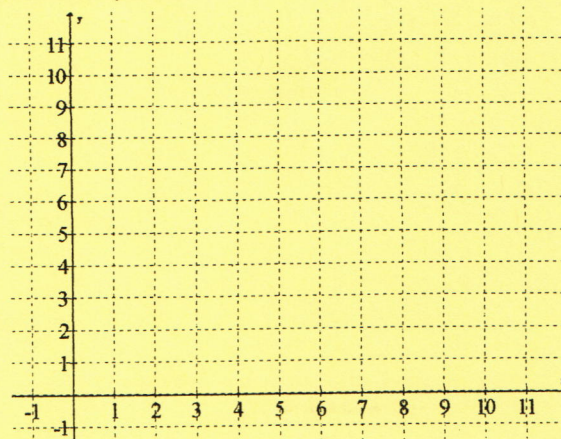
## BAKERY PROBLEM

Ed's bakery is making Whole Wheat Bread and Apple Muffins, and wants to figure out how much of each to make in order to maximize their profits. The bread takes 4 hours to prepare and the muffins take  $\frac{1}{2}$  hour, while the bakery only has 16 hours available for preparation. The bread takes 1 hour to bake, the muffins take  $\frac{1}{2}$  to bake, and the bakery has 10 hours available for baking. The profit on a loaf of bread is \$35 and for muffins it is \$10.

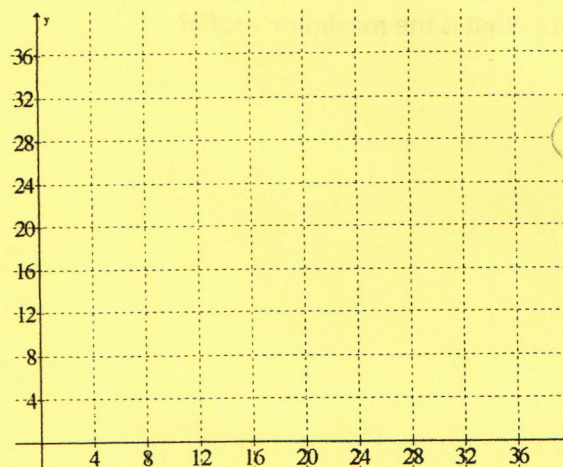




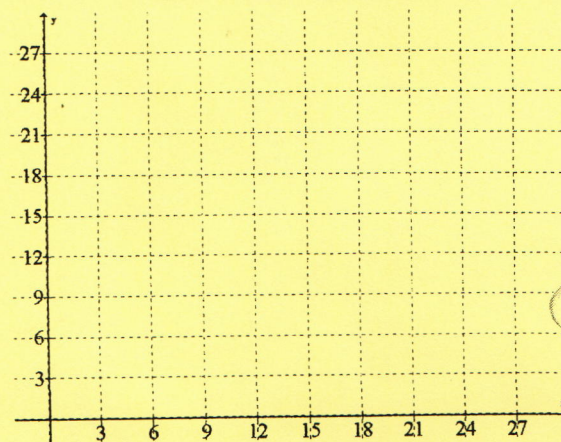
1. A travel agent is organizing a trip for a local ski club. She can make arrangements for a maximum of 10 people, and there must be at least 4 men and 3 women in the group. Her profit is \$12.25 for each woman and \$15.40 for each man. How many men and how many women will give her the maximum profit? What is the maximum profit?



2. A carpentry shop makes dinner tables and coffee tables. Each week the shop must complete at least 9 dinner tables and 13 coffee tables to be shipped to furniture stores. The shop can produce at most 30 dinner tables and coffee tables combined each week. If the shop sells dinner tables for \$120 and coffee tables for \$150, how many of each item should be produced for a maximum weekly income? What is the maximum weekly income?

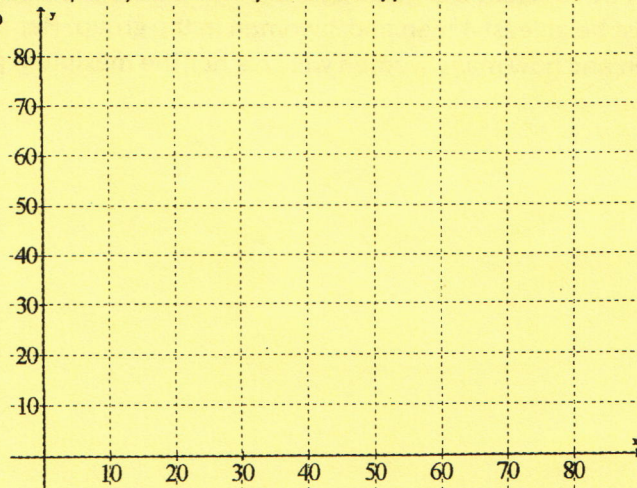


3. Mr. Beauregard raises only pigs and goats, and this year he intends to raise at most 16 animals. There is plenty of room in the goatpen, but a lack of space limits the number of pigs to 8. One other limitation is money: it costs \$5/day to raise a pig and \$2/day to raise a goat, and Mr. Beauregard can spend only \$50/day on the animals. If Mr. Beauregard can make a profit of \$17.50 per goat and \$14.00 per pig, how many of each should he raise to maximize his profit? What is his maximum profit?

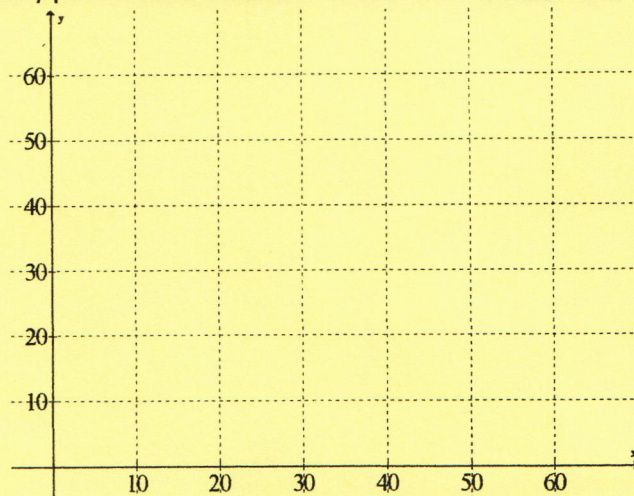




4. Wally's woodworking shop produces 2 sizes of bookcases: large and small. Each week, his staff must produce at least 23 large bookcases and 40 small bookcases to meet demand. The combined total is limited to 75 bookcases because of a shortage of materials. The cost to produce a small bookcase is \$72, while the cost to produce a large bookcase is \$104. If the selling price for the small size is \$125 and the selling price for the large size is \$159, how many of each type should Wally produce each week to maximize his profit? What is his maximum profit?



5. A shoe manufacturer makes outdoor and indoor soccer shoes. There is a two-step manufacturing process for both kinds of shoes. Each pair of outdoor shoes requires 2 hours of processing in step one and 1 hour in step two. Indoor shoes require 1 hour of processing in step one, and 3 hours in step two. The company has only 40 hours of labor available for step one and 60 hours available for step two. The company that sells the manufacturer hard rubber for the outdoor shoes has a limited supply of materials, so the shoe manufacturer can make at most 18 outdoor soccer shoes. Also, outdoor shoes make a profit of \$20 per pair and indoor shoes make a profit of \$15 per pair. How many pairs of each shoe should be made to maximize profit? What is the maximum profit?



6. In Santa Fe, an Indian Cultural Center makes woven blankets and shirts. The Center must make at least 10 items to sell. Each blanket requires 2 hours for dyeing, and 4 hours for weaving. Shirts require 3 hours for dyeing, and 3 hours for weaving. There are 36 and 48 hours available dyeing, and weaving respectively. The Center makes \$22 for each blanket and \$6 for each shirt. How many shirts and blankets should they make in order to maximize their profits?

